Constellation-X Facility Science Team Meeting (FST) — Oct. 14/15, 2004

Constellation X

The Constellation X-ray Mission

Constellation-X Reflector Metrology

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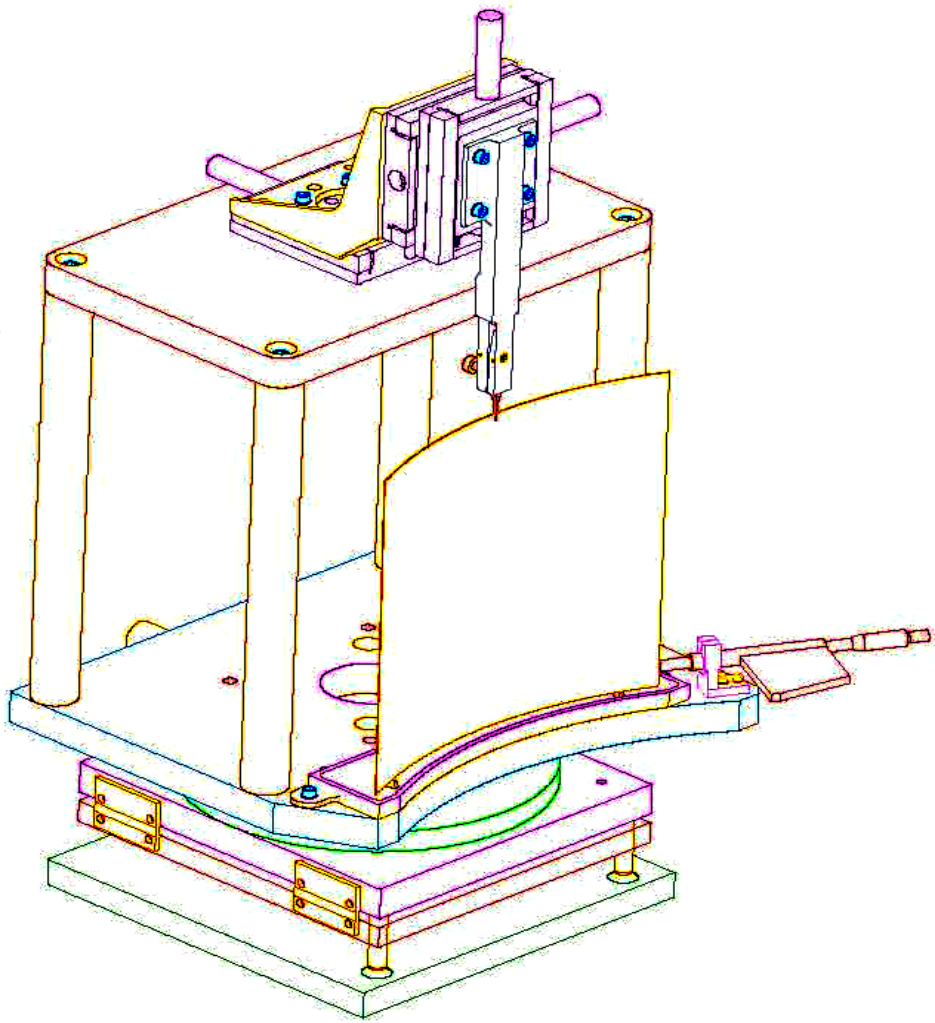
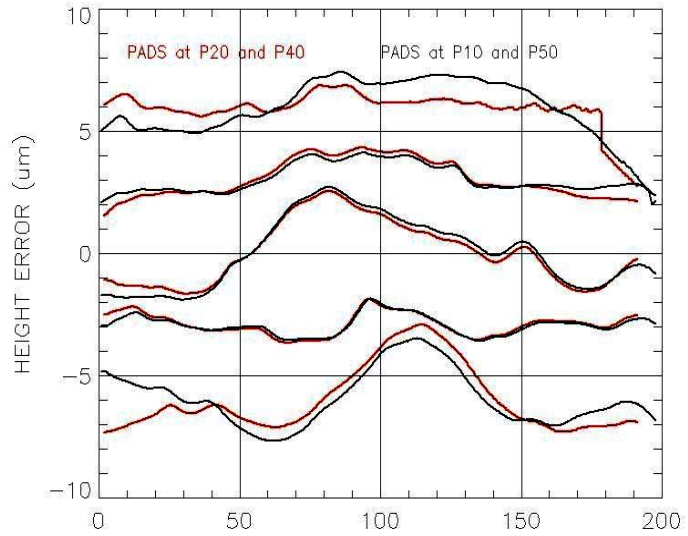
New Reflector Metrology Mount

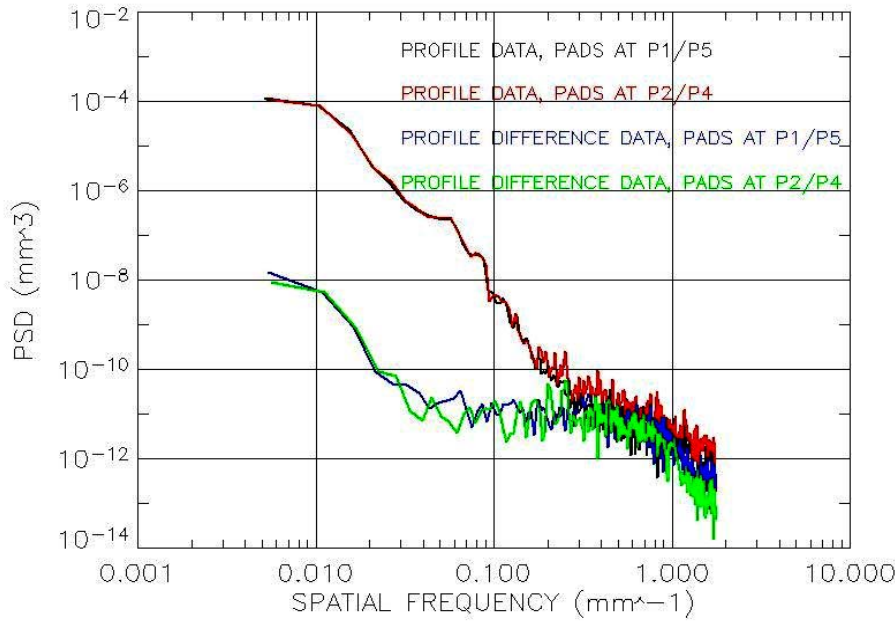
- 3- point mount with reflector positioning controls
  - Improved metrology repeatability
  - Reflector vertical and horizontal positioning more accurate
  - Using the same metrology fixturing in all metrology steps
- Remaining problems
  - Mount/gravity induced distortions
  - Reflector vibration
    - Top corners: 1 μm (P-V) @ 10Hz – 40 Hz
    - Top center: 0.1 μm (P-V) @ 10Hz – 40 Hz



Current axial metrology in new fixture

- **Axial profiles**
  - Measured using WYKO400 interferometer
  - Typically measure 7 locations (P00 – P06)
  - Bottom teflon mounting pads at P02/P04 or P01/P05
  - Central 3 profiles match very well
- **Power Spectral Density (PSD) of axial profiles**
  - Calculate average PSD of profiles
  - Calculate average PSD of profile difference measurements
  - Random errors under control at low frequencies
  - Systematic errors (mounting/gravity) still remain
  - PSD nearly noise limited in 0.2 -2 mm spatial frequency band

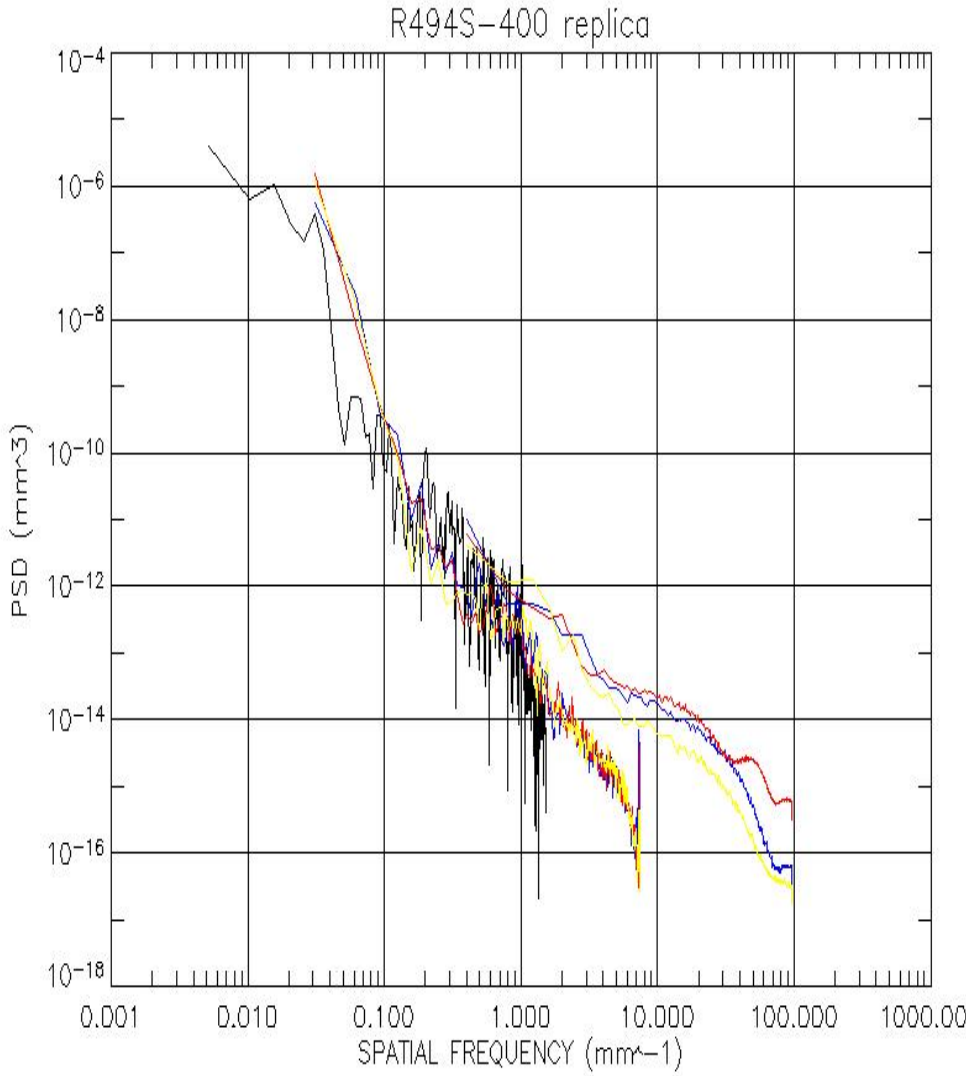




Comparison of Replica metrology

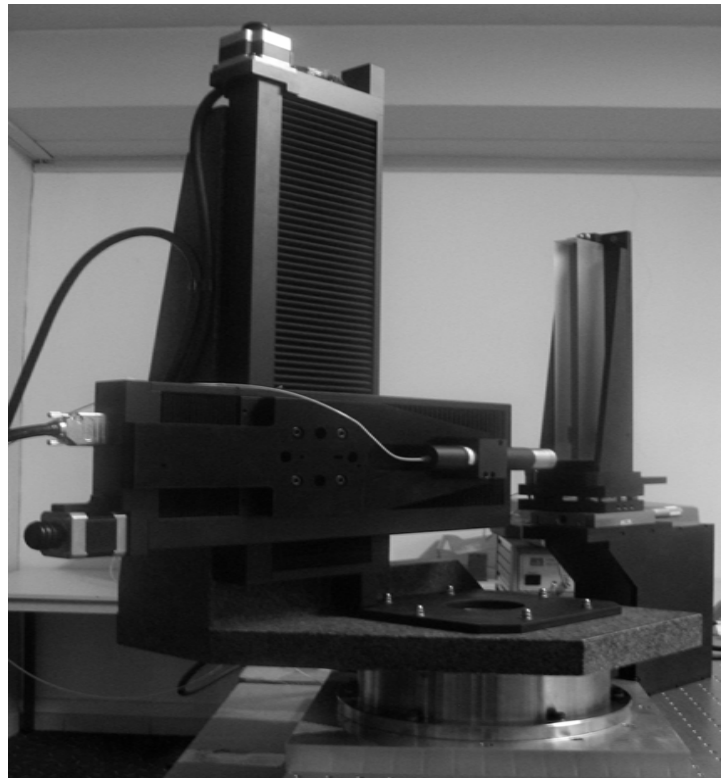
- **WYKO400**
  - 200 mm profile (black)
  - Frequency range: 0.005-1.5 mm^{-1}
- **WYKO400+CGH+ZOOM**
  - 32 mm^2 area (red, yellow, blue)
  - Frequency range: 0.03-7 mm^{-1}
- **PhaseShift (2.5X, micro interferometer)**
  - 2.5 mm^2 area (red, yellow, blue)
  - Frequency range: 0.4-100 mm^{-1}
- **WYKO400, WYKO400+CGH, and PhaseShift data agree in common band pass**
- **WYKO400, WYKO400+CGH not reliable above 1 mm^{-1}**

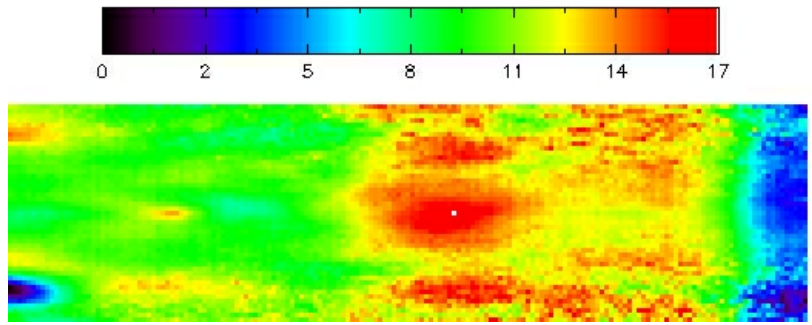
Power Spectral Density vs spatial frequency



Cylindrical non-contact CMM

- Manufactured by OPTIPRO/STIL
- STIL confocal optical probe and high quality stages and encoders
- Specifications:
  - Axial sampling interval: 1 mm
  - azimuth sampling interval: 5 mm
  - Radial range: 115 – 255 mm
  - Measurement time: < 4 hours
  - Axial accuracy: 31 nm, RMS
- First measurement:
  - 45 degrees in azimuth
  - 170 mm in axial length





Contour (μm) of errors (axial L-R)